Cabalzarite

\[ \text{Ca(Mg,Al,Fe)}_2(\text{AsO}_4)_2(\text{H}_2\text{O},\text{OH})_2 \]

**Monoclinic**

**Locality:** The abandoned manganese mine near Falotta, Graubünden, Switzerland.

**Occurrence:** In manganese ore consisting of braunite, rhodonite, spessartine, tinzenite, parsettensite, sursassite and stronatial piemontite in radiolarites. Associated minerals are: quartz, sursassite, “adularia”, kutnohorite, tilasite, grischunite, arseniosiderite, tripuhyite, ranciéite–takanelite and arsenogoyazite.

**General appearance:** Isolated crystals (up to 1 mm), polycrystalline aggregates (up to 2 mm), fibrous to tabular crystals (up to 3 mm) forming radiating aggregates (up to 5 mm in diameter) and aggregates of parallel needles (up to 2 mm thick).

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** light brownish to brownish pink, orange-brown.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** VHN50 429 kg/mm², Mohs ~5.
- **Tenacity:** not given.
- **Cleavage:** none observed.
- **Fracture:** irregular.
- **Density:** 3.89 g/cm³ (meas.), 3.73 g/cm³ (calc.) (for the analytical data given here).
- **Crystallography:** Monoclinic, \( C2/m \), \( a = 8.925, \ b = 6.143, \ c = 7.352 \) Å, \( \beta = 115.25° \), \( V = 364.6 \) Å³, \( Z = 2, a:b:c = 1.4529:1:1.968 \). Morphology: only \( \{001\} \) was recognized. Twinning: none mentioned.
- **X-ray powder-diffraction data:**
- **Optical data:** Because of inhomogeneity, data were difficult to measure; \( n || \) to fiber elongation 1.76, \( n \perp \) to fiber elongation 1.70; mean \( n \) calculated from the Gladstone–Dale relationship 1.77; nonpleochroic.
- **Chemical analytical data:** Mean of four sets of electron-microprobe data: MgO 7.54, CaO 13.64, SrO 0.49, Al₂O₃ 9.84, Mn₂O₃ 0.55, Fe₂O₃ 4.38, SiO₂ 0.05, As₂O₅ 55.57, H₂O 7.11, Total 99.17 wt.%. Empirical formula: \((\text{Ca}_{1.00}\text{Sr}_{0.02})\Sigma_{1.02}(\text{Al}_{0.80}\text{Mg}_{0.77}\text{Fe}_{0.23}\text{Mn}_{0.03})\Sigma_{1.83}(\text{AsO}_4)_2[(\text{H}_2\text{O})_{1.24}(\text{OH})_{0.76}]\Sigma_{2.00}.\)**

**Relationship to other species:** A member of the tsumcorite group, with Mg and Al at the \( M2 \) site.

**Name:** After Walter Cabalzar (b. 1919), an amateur mineralogist of Chur, Switzerland, who contributed to the mineralogy of the canton Graubünden.

**Comments:** IMA No. 1997–012. Note that the crystal structure has been solved.

**BRUGGER, J., MEISSER, N., SCHENK, K., BERLEPSCH, P., BONIN, M., ARMBRUSTER, T., NYFELER, D. & SCHMIDT, S. (2000): Description and crystal structure of cabalzarite \( \text{Ca(Mg,Al,Fe)}_2(\text{AsO}_4)_2(\text{H}_2\text{O},\text{OH})_2 \), a new mineral of the tsumcorite group. American Mineralogist 85, 1307-1314.**
**Calderonite**

\[
Pb_2Fe^{3+}(VO_4)_2(OH)
\]

**Localities**: Las Colmenitas and Los Llanos mine, 2 km northwest of Santa Marta village (Lat. 38°37'N, Long. 6°36'E), Badajoz province, Spain. It also occurs at the La Muda mine, in Azuaga (Lat. 38°20'20"N, Long. 5°47'30"E), Badajoz province, Spain, at the Venus mine, Sierra Gorda, Argentina, and at the Nepomucene mine, Annaberg, Austria.

**Occurrence**: In the upper oxidation zone of the two Pb–Zn hydrothermal deposits. Associated minerals are: vanadinite and descloiizite. Other minerals not directly associated with calderonite are: wulfenite, mimetite, cerussite, beudantite, adamite, hemimorphite, smithsonite, chalcophanite, silver, quartz and Ca–Fe carbonates.

**General appearance**: Scattered clusters of idiomorphic prismatic crystals up to 1 mm long.

**Physical, chemical and crystallographic properties**

- **Luster**: vitreous to resinous.
- **Diaphaneity**: semi-transparent to translucent.
- **Color**: deep orange to red brown.
- **Streak**: red orange.
- **Luminescence**: nonfluorescent.
- **Hardness**: between 3 and 4.
- **Tenacity**: not given.
- **Cleavage**: not given.
- **Fracture**: splintery.
- **Density**: not given, 6.08 g/cm³ (calc.) by the abstractor.
- **Crystallography**: Monoclinic, \( P2_1/m \), \( a = 7.647 \text{ Å}, b = 6.094 \text{ Å}, c = 8.900 \text{ Å}, \beta = 112.0°, V = 384.5 \text{ Å}^3, Z = 2 \). Morphology: no forms were listed, but the SEM photograph shows several forms. Twinning: none mentioned. **X-ray powder-diffraction data**: 4.893(43)(011), 4.166(34)(002), 3.401(21)(202), 3.242(100)(211), 3.058(25)(020), 2.980(48)(103), 2.746(48)(003), 2.449(20)(022). **Optical data**: Biaxial (+), indices of refraction not given (the mean index of refraction calculated by the abstractor from the Gladstone–Dale relationship is 2.25), 2\( V \) (meas.) 86° given as 2\( V_x \), which indicates biaxial (–), dispersion strong; pleochroism: \( X \) light greenish yellow, \( Y \): brown, \( Z \) reddish brown; orientation not given. **Chemical analytical data**: Mean of twenty-one sets of electron-microprobe data (H\( _2 \)O by TGA): PbO 61.80, CaO 0.03, BaO 0.32, CuO 0.67, ZnO 0.09, Al\( _2 \)O\( _3 \) 0.11, Fe\( _2 \)O\( _3 \) 10.12, Mn\( _2 \)O\( _3 \) <0.01, SiO\( _2 \) 0.33, V\( _2 \)O\( _3 \) 23.86, A\( _2 \)S\( _2 \)O\( _5 \) 0.13, P\( _2 \)O\( _5 \) 0.57, H\( _2 \)O 1.91, Total 99.94 wt.%. Empirical formula: \( (\text{Pb}_{1.95} \text{Ba}_{0.01})\Sigma 1.96 (\text{Fe}^{3+}_{0.89} \text{Cu}_{0.06} \text{Al}_{0.02} \text{Zn}_{0.01})\Sigma 0.98 (\text{V}_{1.85} \text{P}_{0.06} \text{Si}_{0.01} \text{As}_{0.01})\Sigma 1.96 \text{O}_{7.51} (\text{OH})_{1.49} \). Ideally, Pb\( _2 \)Fe\( ^{3+} \)(VO\( _4 \))\( _2 \)(OH). **Relationship to other species**: It is the Pb-, Fe\( ^{3+} \)-, VO\( _4 \)-dominant member of the brackebuschite group and, therefore, the Fe\( ^{3+} \)-dominant analogue of brackebuschite and the Pb-dominant analogue of gamagarite.

**Name**: After Salvador Calderón (1852–1911), Professor of Geology of the Central University in Madrid and head of the Mineralogical section of the Natural Sciences Museum there.

**Comments**: IMA No. 2001–022.

**Carbokentbrooksite**

\[(Na,M^\text{II})_{12}(Na,Ce)_3Ca_6Mn_3Zr_3Nb(Si_{25}O_{73})(OH)_3(CO_3)\cdot H_2O\]

**Locality:** Dara-i-Pioz alkaline massif, Tajikistan.

**Occurrence:** In the quartz core of a zoned pegmatite. Associated minerals are: zirsilite-(Ce), quartz, microcline, aegirine, stillwellite-(Ce), ekanite, poly lithionite, pyrochlore, fluorite, calcite and galena.

**General appearance:** As zoned rhombohedral crystals up to 2 cm across, with a carbokentbrooksite core and a zirsilite-(Ce) rim.

**Physical, chemical and crystallographic properties.** *Luster:* vitreous. *Diaphaneity:* transparent.  
*Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* conchoidal. *Density:* 3.14 g/cm\(^3\) (meas.), 3.10 g/cm\(^3\) (calc.).  
**Crystallography:** Trigonal, \(R3m\), \(a = 14.239\), \(c = 30.039\) Å, \(V = 5274\) Å\(^3\), \(Z = 3\). *c/a* = 2.1096.  
*Morphology:* \(\{101\}\), \(\{102\}\), \(\{010\}\), \(\{001\}\). *Twinning:* none mentioned.  
**Optical data:** Uniaxial (−), \(\alpha = 1.645\), \(\gamma = 1.635\), non-pleochroic.  
**Chemical analytical data:** Electron-microprobe data: Na\(_2\)O 10.17, K\(_2\)O 0.51, CaO 10.61, SrO 1.42, MnO 5.41, FeO 2.22, La\(_2\)O\(_3\) 1.79, Ce\(_2\)O\(_3\) 2.97, Pr\(_2\)O\(_3\) 0.24, Nd\(_2\)O\(_3\) 0.76, Y\(_2\)O\(_3\) 0.43, SiO\(_2\) 45.55, TiO\(_2\) 0.41, ZrO\(_2\) 11.07, Nb\(_2\)O\(_5\) 3.55, H\(_2\)O 1.18, Cl 0.29, CO\(_2\) 0.29, sum 99.36, less O = Cl 0.06, Total 99.30 wt.%.  
Empirical formula: (Na\(_9\).48Ca\(_0\).94K\(_0\).36)\(_{\Sigma}10.78\) (Na\(_1\).39Sr\(_0\).45Ce\(_0\).60La\(_0\).36Nd\(_0\).15Pr\(_0\).05)\(_{\Sigma}23.00\)Ca\(_5\).32Mn\(_0\).55 Y\(_0\).13\(_{\Sigma}56.00\) (Zr\(_2\).97Ti\(_0\).03)\(_{\Sigma}3.00\) (Nb\(_0\).88Ti\(_0\).12)\(_{\Sigma}1.02\) Si\(_{25}\).11O\(_73\).62 \((\text{OH})_4\)\(_{4.34}\) Cl\(_{0.27}\)\(_{\Sigma}4.61\) (CO\(_3\))\(_{0.59}\).  
**Relationship to other species**: It is a member of the eudialyte group.

**Name:** Recalls the relationship with kentbrooksite.

**Comments:** IMA No. 2002–056. The indexing of the powder pattern in the paper is somewhat different from that given here.

KHOMYAKOV, A.P., DUSMATOV, V.D., FERRARIS, G., GULA, A., IVALDI, G. & NECHELYUSTOV, G.N. (2003): Zirsilite-(Ce), (Na,M\(^{\text{II}}\))\(_{12}\)(Ce,Na\(_3\))Ca\(_6\)Mn\(_3\)Zr\(_3\)Nb(Si\(_{25}\)O\(_{73}\))(OH\(_3\))(CO\(_3\))\(_\times\)H\(_2\)O and carbokentbrooksite, (Na,M\(^{\text{II}}\))\(_{12}\)(Na,Ce\(_3\))Ca\(_6\)Mn\(_3\)Zr\(_3\)Nb(Si\(_{25}\)O\(_{73}\))(OH\(_3\))(CO\(_3\))\(_\times\)H\(_2\)O, two new eudialyte group minerals from Dara-i-Pioz alkaline massif, Tajikistan. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* 132(5), 40-51 (in Russ.).
**Locality:** Garnet Ridge, Navajo volcanic field, Colorado Plateau, Arizona, U.S.A.

**Occurrence:** In pyrope crystals in an ultramafic diatreme. Associated minerals are: rutile and srilankite. Other minerals in the host crystals are: ilmenite, crichtonite-group minerals, spinel and olivine.

**General appearance:** Anhedral to subhedral elongated platy crystals (up to 30 µm).

**Physical, chemical and crystallographic properties:**
- **Luster:** metallic.
- **Diaphaneity:** opaque; translucent under high magnification.
- **Color:** black, but cinnamon brown in transmitted light.
- **Streak:** not given.
- **Hardness:** ~6, based on its similar polishing quality to rutile.
- **Tenacity:** brittle.
- **Cleavage:** none observed.
- **Fracture:** not given.
- **Density:** not measured, 4.13 g/cm³ (calc.).
- **Crystallography:** Monoclinic, \( P2_1/c \), \( a = 7.706 \) Å, \( b = 4.5583 \) Å, \( c = 20.187 \) Å, \( \beta = 92.334^\circ \), \( V = 708.5 \) Å³, \( Z = 22 \), \( a:b:c = 1.6905:1:4.4286 \). Morphology: no forms were mentioned. Twinning: none observed.
- **Optical data:** In reflected light: gray to white. \( R \) about 18%.

**Chemical analytical data:** Mean of six sets of electron-microprobe data: TiO₂ 62.16, Cr₂O₃ 18.43, Al₂O₃ 1.88, FeO 7.61, MgO 2.80, Nb₂O₅ 0.37, V₂O₃ 0.87, H₂O 5.76, Total (99.88) wt.%. The amount of H₂O was calculated by stoichiometry; its presence was confirmed by IR spectroscopy. Empirical formula: \((Ti_{0.62}Cr_{0.19}Fe_{0.08}Mg_{0.06}Al_{0.03}V_{0.01})O_{1.49}(OH)_{0.51}\). **Relationship to other species:** None apparent.

**Name:** After Prof. Ian S.E. Carmichael (b. 1930), University of California, Berkeley, for his contributions to petrology.

**Comments:** IMA No. 1996–062. Details of the crystal structure are given in the paper.

Carraraite

\[ \text{Ca}_3\text{Ge(OH)}_6(\text{SO}_4)(\text{CO}_3)\cdot12\text{H}_2\text{O} \]

**Locality:** Gioia quarry, Colonnata valley, Carrara basin, Apuan Alps, northern Tuscany, Italy.

**Occurrence:** In calcite vein cavities within the famous Carrara marble. Associated minerals are: azurite and volborthite. It is a product of hydrothermal alteration of copper–vanadium sulfides such as sulvanite and colusite. Crystals of colusite with Ge contents of 1.3 wt.% have been found in the Carrara area.

**General appearance:** Prismatic to tabular submillimetric crystals.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent to translucent.
- **Color:** white.
- **Streak:** white.
- **Luminescence:** not mentioned.
- **Hardness:** not given.
- **Tenacity:** not given.
- **Cleavage:** none observed.
- **Fracture:** not given.
- **Density:** could not be measured because of the small size, 1.97 g/cm³ (calc.).
- **Crystallography:** Hexagonal, \( P6_3/m \), \( a = 11.056 \), \( c = 10.629 \) Å, \( V = 1125.2 \) Å³, \( Z = 2 \), \( c/a = 0.9614 \). Morphology: \{100\}, \{001\}. Twinning: none mentioned.
- **X-ray powder-diffraction data:** 9.57(vs)(100), 5.53(s)(110), 3.83(s)(112), 3.56(ms)(202), 2.74(ms)(302), 2.53(m)(213), 2.38(m)(312), 2.18(m)(223), 2.13(m)(313).
- **Optical data:** Uniaxial (–), \( \alpha 1.509 \), \( \beta 1.479 \), nonpleochroic.

**Chemical analytical data:** Mean of seven sets of electron-microprobe data: CaO 35.70, GeO₂ 18.15, SO₃ 16.19, Total 70.04 wt.%. The sample decomposed in the electron beam. Here, 53.75 wt.% H₂O and 8.75 wt.% CO₂ were added to give 15(H₂O) and 1(CO₃); this raises the analytical total to 132.54 wt.%. Recalculation to give 100.00 wt.% gives: CaO 26.94, GeO₂ 13.69, SO₃ 12.22, CO₂ (6.60), H₂O (40.55), Total (100.00) wt.%. Empirical formula: \( \text{Ca}_3.20\text{Ge}_{0.87}(\text{OH})_{5.84}(\text{SO}_4)_{1.02}(\text{CO}_3)_{1.00}\cdot12.08\text{H}_2\text{O} \).

**Relationship to other species:** It is a member of the ettringite group.

**Name:** After the Carrara region.

**Comments:** IMA No. 1998–002. Because of the very small size of the crystals, many of the usual physical properties could not be determined. Prof. Merlino kindly supplied additional data. The crystal drawing produced here is based on the SEM image in the paper.

Catalanoite

Na₂H(PO₄)•8H₂O

Orthorhombic

**Locality:** Laguna de Santa Maria, about 5 km east of the Argentina–Chile border, in the Andean Puna, Los Andes Department, Salta Province, Argentina (Lat. 24°06’ S, Long. 67°23’ W) and 4,575 m above sea level.

**Occurrence:** It is an evaporite mineral formed in a desert playa lake. Associated minerals are: trona, gaylussite and halite.

**General appearance:** Minute crystals less than 50 and up to 500 µm.


**Name:** After Luciano R. Catalano (1890–1970), well-known Argentine economic geologist and pioneer in the study of Andean salars in the Puna.

**Comments:** IMA No. 2002–008.

Cattiite

\[ \text{Mg}_3(\text{PO}_4)_2 \cdot 22\text{H}_2\text{O} \]

**Locality:** Zhelezny mine, Kovdor Massif, Kola Peninsula, Russia.

**Occurrence:** In cavities in dolomite carbonatite. Associated minerals are: dolomite, bakhchisaraitsevite, nastrophite, magnetite, sjögrenite and carbonate-fluorapatite.

**General appearance:** Crystalline masses up to 1.5 cm.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous, pearly on cleavages.
- **Diaphaneity:** transparent.
- **Color:** colorless.
- **Streak:** white.
- **Luminescence:** not observed.
- **Hardness:** 2.
- **Tenacity:** not mentioned.
- **Cleavage:** \{001\} perfect.
- **Fracture:** uneven.
- **Density:** 1.65 g/cm\(^3\) (meas.), 1.64 g/cm\(^3\) (calc.).
- **Crystallography:** Triclinic, \(P\bar{1}\), \(a\) 6.932, \(b\) 6.925, \(c\) 16.154 Å, \(\alpha\) 82.21, \(\beta\) 89.70, \(\gamma\) 119.51°, \(V\) 666.3 Å\(^3\), \(Z = 1\), \(a:b:c = 1.0010:1:2.3327\).
- **Morphology:** \{001\}. Twinning: none mentioned.
- **Optical data:** Biaxial (−), \(\alpha\) 1.459, \(\beta\) 1.470, \(\gamma\) 1.470, 2V(meas.) 25°, 2V(calc.) 0°; dispersion \(r < v\), weak; nonpleochroic; \(X \cap c = 80°\), \(Y \cap a = 10°\), \(Z \cap c = 90°\), optic axial plane close to (001).

**Name:** After Michele Catti (b. 1945), Professor of Physical Chemistry, University of Milano Bicocca, Italy, for his contributions to the crystal chemistry of hydrated oxysalts.

**Comments:** IMA No. 2000–032.

**Cavoite**

**CaV$_3$O$_7$**

**Locality:** Gambatesa mine, near Reppia, northern Appenines, Val Graveglia, Liguria, Italy.

**Occurrence:** In micro-cavities in massive bands of caryopilite + calcian rhodochrosite ± quartz. Another associated mineral is an unidentified silicate.

**General appearance:** Very rare radiating aggregates of strongly elongate prismatic to acicular crystals up to about 0.28 mm long.

**Physical, chemical and crystallographic properties:** *Luster:* vitreous to adamantine. *Diaphaneity:* transparent. *Color:* colorless to olive green-brown. *Streak:* near white. *Luminescence:* nonfluorescent. *Hardness:* could not be determined. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* not mentioned. *Density:* could not be determined, 3.51 g/cm$^3$ (calc.). **Crystalllography:** Orthorhombic, *Pnam,* $a$ 10.42, $b$ 5.28, $c$ 10.34 Å, $V$ 568.2 Å$^3$, $Z$ = 4, $a:b:c$ = 1.9735:1:1.9583. Morphology: no forms were mentioned. Twinning: none observed. **X-ray powder-diffraction data:** 5.16(M)(200), 3.45(W)(211,112), 3.00(S)(212), 2.88(W)(013,203), 1.85(M)(024), 1.56(W)(612,033,216). **Optical data:** could not be determined, but a value of about 2 was measured roughly for the index of refraction. **Chemical analytical data:** Means of ten sets of electron-microprobe data: K$_2$O 0.35, CaO 17.76, MnO 0.70, SiO$_2$ 4.31, VO$_2$ 76.80, Total 99.92 wt.%. **Empirical formula:** (Ca$_{0.95}$Mn$_{0.03}$K$_{0.02}$)$_0^1$($V_{2.79}$Si$_{0.22}$)$_0^1$O$_7$. **Relationship to other species:** It is the natural analogue of synthetic CaV$_3$O$_7$.

**Name:** Recalls the chemical composition, calcium, vanadium, oxygen.

**Comments:** IMA No. 2001–024.

Čejkaite

\[
\text{Na}_4(\text{UO}_2)(\text{CO}_3)_3
\]

**Locality:** The Geschieber vein, Svornost mine, Jáchymov, northwestern Bohemia, Czech Republic.

**Occurrence:** An efflorescence on a calcite vein with disintegrated uraninite in a single specimen. Secondary associated minerals are andersonite and schröckingerite, but they are not in direct contact with Čejkaite.

**General appearance:** An earthy efflorescence consisting of crystals from 0.2 to 0.6 µm.

**Physical, chemical and crystallographic properties:** Luster: vitreous. Diaphaneity: not observed. Color: pale yellow to beige. Streak: light yellow. Luminescence: fluoresces weak yellow to yellow-green in short- and long-wave ultraviolet light. Hardness: could not be determined. Tenacity: could not be determined. Cleavage: could not be determined. Fracture: could not be determined. Density: 3.67 g/cm\(^3\) (meas.), 3.77 g/cm\(^3\) (calc.). Crystallography: Triclinic, \(P_1\) or \(P\overline{1}\), \(a\ 9.291, b\ 9.292, c\ 12.895 \, \text{Å}, \alpha 90.73, \beta 90.82, \gamma 120.00^\circ; V 963.7 \, \text{Å}^3, Z = 4, a:b:c = 0.9999:1:1.3878\). Morphology: no forms were identified, but individual crystallites display indistinct hexagonal morphology in TEM images. Twinning: nonmentioned. X-ray powder-diffraction data: 8.022(92) (1\(\overline{1}0\),010,100), 5.080(57)(\(\overline{1}02,0\overline{1}2\), 5.024(60)(\(\overline{1}12,1\overline{1}2\), 4.967(68)(012,102), 4.639(100)(1\(\overline{2}0,2\overline{1}0,110\), 3.221(63)(004), 2.681(60)(330,1\(\overline{1}4,0\overline{3}0,300\)). Optical data: could not be determined owing to the extremely small grain-size. The mean index of refraction derived from Gladstone–Dale calculations is 1.5825, which is consistent with the mean index of refraction measured for the trigonal polymorph of \(\text{Na}_4(\text{UO}_2)(\text{CO}_3)_3\). Chemical analytical data: A combination of ICP–MS and thermal analysis (with CO\(_2\) by difference) gave: \(\text{Na}_2\text{O} 21.39, \text{MgO} 0.15, \text{FeO} 0.53, \text{UO}_3 53.93, \text{CO}_2 (24.00), \text{Total} (100.00)\) wt.%. Empirical formula: \((\text{Na}_{3.77}\text{Fe}_{0.04}\text{Mg}_{0.02})_{\Sigma 3.83}(\text{UO}_2)_{1.03}(\text{CO}_3)_{2.98}\). Relationship to other species: It is structurally similar to synthetic trigonal \(\text{Na}_4(\text{UO}_2)(\text{CO}_3)_3\).

**Name:** After Jiří Čejka (b. 1929), former Director of the Museum of Natural History of the National Museum in Prague, in recognition of his numerous contributions to the crystal chemistry of uranium minerals.

**Comments:** IMA No. 1999–045.

**Cerchiaraite**

\[ \text{Ba}_4\text{Mn}_4\text{Si}_6\text{O}_{18}(\text{OH})_7\text{Cl} \]

**Locality:** The Cerchiara mine, near Faggiona village, val di Vara, La Spezia, northern Apennines, eastern Liguria, Italy.

**Occurrence:** Filling microfractures and veins (from 0.1 to some millimeters in width) in Jurassic cherts of the “Diaspra di Monte Alpe” Formation. Associated minerals are: quartz, pectolite, orientite and calcite. Other new minerals found at the locality are mozartite, CaMn(OH)SiO₄, and caoxite, CaC₂O₄•3H₂O.

**General appearance:** Scattered individual prismatic to acicular crystals elongated along [001] (up to 2 ± 0.1 mm) and as a few radiating aggregates (up to about 3 mm in diameter).

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** deep green.
- **Streak:** pale green.
- **Luminescence:** nonfluorescent.
- **Hardness:** VHN₂₉ 296 kg/mm².
- **Tenacity:** brittle.
- **Cleavage:** none.
- **Fracture:** uneven.
- **Density:** 3.62 g/cm³ (meas.), 3.69 g/cm³ (calc.).
- **Crystallography:** Tetragonal, \( \text{I}_4/\text{mmm} \), \( a = 14.223 \) Å, \( c = 6.141 \) Å, \( V = 1242.3 \) Å³, \( Z = 2 \), \( c/a = 0.4318 \). Morphology: tetragonal prisms are present but not identified. Twinning: none mentioned.

**X-ray powder-diffraction data:**


**Optical data:** Uniaxial (+), \( \varepsilon \) 1.745, \( \gamma \) 1.765.

**Chemical analytical data:** Mean of 42 sets of electron-microprobe data: BaO 43.29, Al₂O₃ 1.02, Fe₂O₃ 2.09, Mn₂O₃ 19.57, SiO₂ 26.18, H₂O (4.81), Cl 3.93, sum 100.89, less O = Cl 0.89. Total (100.00) wt.% The amount of H₂O was calculated by difference. Empirical formula: \( \text{Ba}_{3.83}(\text{Mn}^{3+}_{3.36}\text{Fe}^{3+}_{0.35}\text{Al}_{0.27})\Sigma_{3.98}\text{Si}_{5.91}\text{O}_{17.26}(\text{OH})_{7.24}\text{Cl}_{1.50}\Sigma_{8.74} \).

**Relationship to other species:** It is a cyclosilicate.

**Name:** After the locality.

**Comments:** IMA No. 1999–012. Some of the subscripts derived here for the empirical formula differ from those given by the authors.

Cerite-(La)

(La, Ce, Ca)₉(Fe, Ca, Mg)(SiO₄)₃[SiO₃(OH)]₄(OH)₃

TRIGONAL

**Locality:** Mt. Yukspor, Khibina massif, Kola Peninsula, Russia.

**Occurrence:** In an aegirine – natrolite – microcline vein in foyaite. Associated minerals are: aegirine, anatase, ancylite-(Ce), barylite, catapleiite, cerite-(Ce), chabazite-Ca, edingtonite, fluorapatite, galena, ilmenite, microcline, natrolite, sphalerite, strontianite and vanadinite.

**General appearance:** Porous pseudomorphs (up to 7 cm long) after an unidentified hexagonal prismatic mineral, possibly belovite-(Ce). Cerite-(La) occurs as framework-like aggregates of crystals up to 2 mm across within the pseudomorphs.

**Physical, chemical and crystallographic properties:**

- **Luster:** vitreous.
- **Diaphaneity:** translucent.
- **Color:** light yellow to pinkish brown.
- **Streak:** white.
- **Luminescence:** not mentioned.
- **Hardness:** 5.
- **Tenacity:** brittle.
- **Cleavage:** not observed.
- **Fracture:** conchoidal.
- **Density:** 4.7 g/cm³ (meas.), 4.75 g/cm³ (calc.).

**Crystallography:** Trigonal, R3c, a 10.7493, c 38.318 Å, V 3834.4 Å³, Z = 6, c:a = 3.5647. Morphology: {102} and {001}, habit equant to tabular on {001}. Twinning: none mentioned. **X-ray powder-diffraction data:** 3.53(26)(1.0.10, 211), 3.47(40)(122), 3.31(38)(214), 3.10(25)(300), 2.958(100)(0.2.10), 2.833(37)(128), 2.790(24)(306), 2.689(34)(220), 1.949(34)(238,1.3.13).

**Optical data:** Uniaxial (+), T 1.810, g 1.820, nonpleochroic.

**Chemical analytical data:** Mean of 42 to 70 sets of electron-microprobe data (with H₂O by the Penfield method) gave: MgO 0.51, CaO 5.09, SrO 1.97, Fe₂O₃ 1.40, La₂O₃ 37.57, Ce₂O₃ 23.67, Pr₂O₃ 0.61, Nd₂O₃ 1.48, Sm₂O₃ 0.10, Gd₂O₃ 0.24, SiO₂ 22.38, P₂O₅ 0.63, H₂O 3.20, Total 98.85 wt.%. Empirical formula: (La₄.26Ce₂.67Ca₁.38Sr₀.35Nd₀.16Pr₀.07Gd₀.02Mg₀.10)Σ₉.92(Fe₀.32Ca₀.30Mg₀.23)Σ₂.85(SiO₄)₃.₀₀[(Si₀.₈₄P₀.₁₆)Σ₁.₀₆O₃.₁₁(OH)]₄(OH)₂.₅₆. **Relationship to other species:** It is the La-dominant analogue of cerite-(Ce).

**Name:** Reflects its composition as the La-dominant analogue of cerite-(Ce).

**Comments:** IMA No. 2001–042.

Chabazite-Sr

$(\text{Sr, Ca})[\text{Al}_2\text{Si}_4\text{O}_{12}]\cdot6\text{H}_2\text{O}$

**Locality:** Suoluiv Mountain, Lovozero alkaline complex, Kola Peninsula, Russia.

**Occurrence:** In a thin aegirine–K-feldspar pegmatite cross-cutting nepheline and nosean syenites. Associated minerals are: analcime, gonnardite, vinogradovite, phillipsite, lavenite, seidozerite, fluorapatite, aegirine, K-feldspar, nepheline, ilmenite, lorenzenite and sodalite.

**General appearance:** Coarse disk-like crystals (up to 0.3 mm). Open-book-like aggregates are in cavities of corroded analcime crystals.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous.
- **Diaphaneity:** transparent.
- **Color:** colorless or yellowish.
- **Streak:** white.
- **Luminescence:** nonfluorescent.
- **Hardness:** 4 to 4½.
- **Tenacity:** brittle.
- **Cleavage:** {101} medium.
- **Fracture:** rough.
- **Density:** 2.16 g/cm$^3$ (meas.), 2.25 g/cm$^3$ (calc.).

**Crystallography:**
- Trigonal, $R\overline{3}m$, $a$ 13.715, $c$ 15.09 Å, $V$ 2458 Å$^3$, $Z$ = 6, $c:a$ = 1.1003. Morphology: only {113} was observed. Twinning: on the “phacolite” law.
- **X-ray powder-diffraction data:** 9.38 (8) (101), 5.55 (6) (021), 4.34 (7) (211), 2.92 (10) (401), 1.697 (7) (524, 700, 530).
- **Optical data:** Uniaxial (+), $\omega$ 1.503, $\epsilon$ 1.507, nonpleochroic.

**Chemical analytical data:**
- Electron-microprobe data: Na$_2$O 0.85, K$_2$O 2.97, CaO 4.79, SrO 10.32, BaO 0.36, Al$_2$O$_3$ 21.74, SiO$_2$ 40.33, H$_2$O 18.40, Total 99.76 wt.%. Empirical formula: $(\text{Sr}_{0.55}\text{Ca}_{0.48}\text{K}_{0.35}\text{Na}_{0.015}\text{Ba}_{0.01})\Sigma1.54(\text{Si}_{3.73}\text{Al}_{2.37})\Sigma6.10\cdot5.68\text{H}_2\text{O}$.

**Relationship to other species:** A member of the zeolite group, the Sr-dominant member of the chabazite series.

**Name:** Reflects the relationship with the chabazite series of zeolites and the dominance of Sr.

**Comments:** IMA No. 1999–040.

Chabazite-Sr, $(\text{Sr, Ca})[\text{Al}_2\text{Si}_4\text{O}_{12}]\cdot6\text{H}_2\text{O}$, a new zeolite mineral from Lovozero massif, Kola Peninsula. *Zapiski Vserossiiskogo Mineralogicheskogo Obshchestva* **129(4)**, 54-58 (in Russ.).
Chromceladonite

KCrMg\([Si_4O_{10}](OH)_2\)

MONOCLINIC

Locality: Srednyaya Padma uranium–vanadium deposit, southern Karelia, Russia.

Occurrence: In a metasomatic rock. Associated minerals are: dolomite, quartz, roscoelite, chromphyllite, calcite, hematite, uraninite, zincochromite, vanadium oxides, among others.

General appearance: Aggregates of thin lamellae (up to 1 cm) and as spherulites and veinlets.

Physical, chemical and crystallographic properties

Luster: vitreous to silky. Diaphaneity: transparent. Color: emerald green to dark green. Streak: light green. Luminescence: nonfluorescent. Hardness: 1½ to 2. Tenacity: flexible but not elastic. Cleavage: \{001\} perfect. Fracture: platy. Density: 2.90 g/cm³ (meas.), 2.97 g/cm³ (calc.). Crystallography: Monoclinic, \(C_2\), \(a\) 5.267, \(b\) 9.101, \(c\) 10.162 \(\text{Å}\), \(\beta\) 100.67°, \(V\) 479 \(\text{Å}^3\), \(Z = 2\), \(a:b:c = 0.5787:1:1.1166\). Morphology: probably only \{001\}. Twinning: none observed. X-ray powder-diffraction data: 4.54(93)(020), 4.36(40)(11\(\overline{1}\)), 3.638(64)(11\(\overline{2}\)), 3.097(51)(112), 2.588(100)(13\(\overline{1}\)), 2.409(87)(13\(\overline{2}\)), 1.518(56)(33\(\overline{1}\)). Optic data: Biaxial (−), \(\alpha\) 1.605, \(\beta\) 1.648, \(\gamma\) 1.654, 2V(meas.) 12°, 2V(calc.) 40°; dispersion not observed; pleochroism: \(X\) colorless to pale green, \(Y = Z\) green; \(\chi A\) (001) < 5°. Chemical analytical data: Ten electron-microprobe analyses were carried out, with Li, Fe\(^{2+}\), and Fe\(^{3+}\) determined by wet-chemical means. Data for the holotype specimen are: Li\(_2\)O 0.13, Na\(_2\)O 0.14, K\(_2\)O 10.42, MgO 7.82, MnO 0.19, FeO 0.73, ZnO 0.22, Al\(_2\)O\(_3\) 3.25, V\(_2\)O\(_3\) 1.79, Cr\(_2\)O\(_3\) 17.01, Fe\(_2\)O\(_3\) 0.58, SiO\(_2\) 53.20, TiO\(_2\) 0.16, H\(_2\)O 3.38, F 0.57, sum 99.59, less O = F 0.24, Total 99.35 wt.%. Empirical formula: (K\(_{0.97}\)Na\(_{0.02}\))\(_{\Sigma 1.00}\)(Cr\(_{0.97}\)V\(_{0.02}\)Al\(_{0.09}\)Fe\(^{3+}\)\(_{0.03}\)Ti\(_{0.01}\))\(_{\Sigma 1.20}\)(Mg\(_{0.84}\)Fe\(^{2+}\)\(_{0.04}\)Li\(_{0.04}\)Zn\(_{0.01}\)Mn\(_{0.01}\))\(_{\Sigma 0.94}\)(Si\(_{3.82}\)Al\(_{0.18}\))\(_{\Sigma 4.00}\)(OH\(_{1.62}\)O\(_{0.25}\)F\(_{0.13}\))\(_{\Sigma 2.00}\). Relationship to other species: A member of the mica group.

Name: Reflects the composition of the mica and its relationship to celadonite.

Comments: IMA No. 1999–024.

Ciprianiite

\[
\text{Ca}_4[(\text{Th},\text{U})(\text{REE})]\text{AlM}_2(\text{Si}_4\text{B}_4\text{O}_{22})(\text{OH},\text{F})_2
\]

MONOCLINIC

**Locality:** Tre Croce, near Vetralla, Viterbo province, Latium, Italy.

**Occurrence:** In miarolitic cavities in a syenitic ejectum within a pyroclastic formation. Associated minerals are: danburite, thorite, fluorite, tourmaline and a cancrinite-group mineral.

**General appearance:** Small (<0.5 mm) tabular crystals.

**Physical, chemical and crystallographic properties:**
- **Luster:** vitreous. **Diaphaneity:** translucent to transparent. **Color:** brown to pale brown. **Streak:** white. **Luminescence:** nonfluorescent. **Hardness:** not given. **Tenacity:** brittle. **Cleavage:** {100} fair to good. **Fracture:** conchoidal. **Density:** could not be measured, 3.97 g/cm\(^3\) (calc.).
- **Crystallography:** Monoclinic, \(P2_1/a\), \(a\ 19.059\), \(b\ 4.729\), \(c\ 10.291\ \text{Å}\), \(\beta\ 111.33°\), \(V\ 864.0\ \text{Å}^3\), \(Z = 2\), \(a:b:c = 4.0302:1.2.1761\). **Morphology:** {010}, tabular. **Twining:** frequent on (100).
- **Optical data:** could not be determined.
- **Chemical analytical data:** Mean of two to four sets of electron-microprobe data (light elements by SIMS): Li\(_2\)O 0.05, BeO 1.95, MgO 0.18, CaO 24.60, BaO 0.00, B\(_2\)O\(_3\) 13.28, Al\(_2\)O\(_3\) 2.33, Cr\(_2\)O\(_3\) 0.02, Mn\(_2\)O\(_3\) 0.37, Fe\(_2\)O\(_3\) 2.87, Y\(_2\)O\(_3\) 0.19, La\(_2\)O\(_3\) 1.39, Ce\(_2\)O\(_3\) 5.48, Pr\(_2\)O\(_3\) 0.86, Nd\(_2\)O\(_3\) 3.03, Sm\(_2\)O\(_3\) 0.33, Eu\(_2\)O\(_3\) 0.05, Gd\(_2\)O\(_3\) 0.14, Dy\(_2\)O\(_3\) 0.05, Er\(_2\)O\(_3\) 0.01, Yb\(_2\)O\(_3\) 0.01, SiO\(_2\) 22.94, TiO\(_2\) 0.73, ThO\(_2\) 15.80, UO\(_2\) 0.87, H\(_2\)O 0.47, F 0.89, sum 98.89, less O = F 0.37, Total 98.52 wt.%

**Relationship to other species:** It is a member of the hellandite group.

**Name:** After Curzio Cipriani (b. 1927), Professor of Mineralogy and Head of the Museum of Mineralogy, later of Natural History, at the Università di Firenze, Italy.

**Comments:** IMA No. 2000–021.


**Clearcreekite**

\[ \text{Hg}^{1+3}\text{(CO}_3\text{)(OH)}\cdot2\text{H}_2\text{O} \]

**Locality**: A small prospect pit near the long-abandoned Clear Creek mercury mine, New Idria district, San Benito County, California, U.S.A.

**Occurrence**: In a brecciated rock consisting mainly of ferroan magnesite and quartz. Associated minerals are cinnabar and edoylerite.

**General appearance**: A small cluster of subhedral crystals (up to 0.17 mm).

**Physical, chemical and crystallographic properties**:
- **Luster**: given as vitreous but optical data indicate adamantine.
- **Diaphaneity**: transparent.
- **Color**: pale greenish yellow.
- **Streak**: pale greenish yellow.
- **Luminescence**: nonfluorescent.
- **Hardness**: could not be measured, but probably is low.
- **Tenacity**: brittle.
- **Cleavage**: \{001\} good.
- **Fracture**: uneven.
- **Density**: could not be measured, 6.82 g/cm\(^3\) (calc.).
- **Crystallography**: Monoclinic, \(P2_1/c\), \(a = 6.760, b = 9.580, c = 10.931\) Å, \(\beta = 105.53^\circ\), \(V = 682.1\) Å\(^3\), \(Z = 4\), \(a:b:c = 0.7056:1:1.1410\). Morphology: \{001\} major and \{010\} minor. Twinning: none mentioned.
- **X-ray powder-diffraction data**: 7.09\(\{(011)\), 5.40\(\{(110)\), 5.32\(\{(\overline{1}11)\), 4.62\(\{(012)\), 3.058\(\{(031)\), 2.831\(\{(023)\), 2.767\(\{(100)\), 2.486\(\{(202)\), 2.391\(\{(040)\), 1.692\(\{(244,402)\).
- **Optical data**: No data could be measured. Indices of refraction probably are higher than 2.
- **Chemical analytical data**: An electron-microprobe analysis gave Hg\(_2\)O 84.65%; values of CO\(_2\) and H\(_2\)O of 6.16 and 6.30%, respectively, were calculated from the crystal-structure data, for a total 97.11 wt.%. Empirical formula: \(\text{Hg}^{1+2.92}\text{(CO}_3\text{)}_{1.01}\text{(OH)}_{0.90}\cdot2.07\text{H}_2\text{O}\).

**Relationship to other species**: It is the monoclinic polymorph of \(\text{Hg}^{1+3}\text{(CO}_3\text{)(OH)}\cdot2\text{H}_2\text{O}\), peterbaylissite being orthorhombic.

**Name**: After the locality.

**Comments**: IMA No. 1999–003. The crystal structure has been solved.

Clinobarylite
BaBe₂Si₂O₇
MONOCLINIC

Locality: Mount Yukspor, Khibina massif, Kola Peninsula, Russia.

Occurrence: In four alkaline pegmatite veins. Associated minerals are: natrolite, aegirine, microcline, catapleiite, fluorapatite, titanite, fluorite, galena, sphalerite, strontianite, annite, astrophyllite, lorenzenite, labuntsovite-Mn, kuzmenkoite-Mn, cerite-(Ce), edingtonite, ilmenite and calcite.

General appearance: Platy to prismatic crystals (up to 20 4  1 mm) and radiating aggregates.

Physical, chemical and crystallographic properties:

Luster: strong, vitreous.
Hardness: 6½. Tenacity: brittle. Cleavage: {100} perfect, {001} and {101} less perfect.
Fracture: uneven. Density: 3.97 g/cm³ (meas.), 4.10 g/cm³ (calc.).
Crystallography:
Monoclinic, Pm, a 11.618, b 4.904, c 4.655 Å, β 89.94°, V 265.2 Å³, Z = 2, a:b:c = 2.3691:1:0.9492. Morphology: {100}, {010}, {201}, {201}; less common forms are {610}, {101}, {101}. Twinning: micro-twinning about [010].
X-ray powder-diffraction data:
Optical data: Biaxial (+), α 1.698, β 1.700, γ 1.705, 2V(meas.) 70°, 2V(calc.) 65°; dispersion not observed; nonpleochroic; Xαa = 6°, Yαc 5.5°, Z = b.
Chemical analytical data: Mean of four sets of electron-microprobe data (BeO by atomic emission): BaO 47.66, BeO 14.90, SiO₂ 36.38, Total 98.94 wt.%. Empirical formula: Ba₁.0₃Be₁.9₇Si₂.₀₀O₇.₀₀. Relationship to other species: It has a dimorphic relationship with barylite (orthorhombic).

Name: Reflects the relationship to barylite.


Cobaltkieserite
CoSO$_4$$\cdot$H$_2$O

**Locality:** Bastnäs, Skinnskatteberg, Sweden (Lat. 59°51’N, Long. 15°35’E).

**Occurrence:** In a dark, dense quartzitic rock. Associated minerals are: cobaltite, pyrite, chalcopyrite, quartz, garnet, scorodite and erythrite.

**General appearance:** Euhedral crystals (0.5 to 3 µm).

**Physical, chemical and crystallographic properties:**
- **Luster:** powdery.
- **Diaphaneity:** not given.
- **Color:** pink.
- **Streak:** not given.
- **Luminescence:** not mentioned.
- **Hardness:** 2 to 3.
- **Tenacity:** not given.
- **Cleavage:** not given.
- **Fracture:** not given.
- **Density:** could not be measured, 3.28 g/cm$^3$ (calc.).
- **Crystallography:** Monoclinic, $C2/c$ (by analogy with synthetic material), $a$ 6.980, $b$ 7.588, $c$ 7.639 Å, $\beta$ 118.65°, $V$ 355.06 Å$^3$, $Z$ = 4, $a:b:c$ = 0.9199:1:1.0067.
- **Morphology:** no forms were identified, but the crystals are largely euhedral with a thick tabular to “bipyramidal” habit. Twinning: none mentioned.
- **Optical data:** Biaxial (+), no other data could be determined because of the minuteness of the crystals.
- **Chemical analytical data:** Mean of twenty sets of electron-microprobe data (H$_2$O calculated): CoO 42.7, FeO 0.2, SiO$_2$ 0.3, As$_2$O$_5$ 4.3, SO$_3$ 44.2, H$_2$O (10.5), Total (102.2) wt.%. Empirical formula: Co$_{0.98}$(S$_{0.95}$As$_{0.06}$Si$_{0.01}$)$_{1.02}$O$_{4.00}$•1.00H$_2$O. **Relationship to other species:** It is the cobalt-dominant analogue of kieserite, MgSO$_4$$\cdot$H$_2$O.

**Name:** Reflects the relationship to kieserite.

**Comments:** IMA No. 2002–004. Slowly soluble in water.

Cobaltneustädtelite

Bi$_2$Fe$_{3+}$Co$_{2+}$O(OH)$_3$(AsO$_4$)$_2$

**Locality.** The dumps of the Güldener Falk mine near Schneeberg–Neustädtel, Schneeberg area, Saxony, Germany. It also has been found on the dumps of other mines in the area: Siebenschlecken, Junge Kalbe, Friedefürst and Peter und Paul.

**Occurrence:** Associated minerals are: quartz, neustädtelite, preisingerite and goethite; rarely found with mixite, zeunerite and bismutite.

**General appearance:** Crystal aggregates (up to 0.3 mm) and as very small tabular crystals usually <0.1 mm thick. One specimen has crystals up to 0.2 mm in diameter and 0.1 mm thick.

**Physical, chemical and crystallographic properties**

- **Luster:** adamantine.
- **Diaphaneity:** transparent to translucent.
- **Color:** brown.
- **Streak:** light brown.
- **Luminescence:** nonfluorescent.
- **Hardness:** 4½.
- **Tenacity:** brittle.
- **Cleavage:** {001} good.
- **Fracture:** conchoidal.
- **Density:** could not be measured, 5.81 g/cm$^3$ (calc.).

**Crystallography:** Triclinic, $P\overline{1}$, $a$ 9.156, $b$ 6.148, $c$ 9.338 Å, $\alpha$ 83.24°, $\beta$ 70.56°, $\gamma$ 86.91°, $V$ 492.2 Å$^3$, $Z$ = 2, $a$:$b$:$c$ = 1.4893:1:1.5189.

- **Morphology:** {001}, {100}, “{011}”, rarely {201}; the form given as “{011}” could not be measured accurately and may be {143}.
- **Twinning:** none observed.
- **Optical data:** Biaxial (–), $\alpha$ 2.02, $\beta$ 2.09 (calc.), $\gamma$ 2.12, 2$V$(meas.) 65°, no distinct dispersion observed; pleochroism strong, $X$ brown to opaque, $Y$ yellow, $Z$ pale yellow; $\phi$ and $\rho$ relative to (010): $X$ –166° and 86°, $Y$ –74° and 76°, $Z$ 88° and 15°.

**Chemical analytical data:** Mean of fifteen sets of electron-microprobe data: CaO 0.32, NiO 1.61, CoO 5.47, CuO <0.05, ZnO 0.39, PbO 0.08, Al$_2$O$_3$ 0.07, Fe$_2$O$_3$ 10.90, Bi$_2$O$_3$ 51.54, P$_2$O$_5$ 0.43, As$_2$O$_3$ 25.91, H$_2$O 3.01, Total 99.73 wt.%. Empirical formula: (Bi$_{1.91}$Ca$_{0.05}$)$_{1.96}$Fe$_{1.02}$O$_{0.63}$Ni$_{0.19}$Fe$_{0.16}$Zn$_{0.04}$Al$_{0.01}$Σ$^{1.01}$[(OH)$_{1.02}$O$_{1.12}$]Σ$^{1.00}$[(AsO$_4$)$_{1.95}$PO$_4$]Σ$^{2.00}$. A Relationship to other species: It is a member of the medenbachite group, specifically the Co$^{2+}$-dominant member.

**Name:** Reflects the relationship with neustädtelite.

**Comments:** IMA No. 2000–012.

**Cobalttsumcorite**

\[
Pb(\text{Co}, \text{Fe}^{3+})_2(\text{AsO}_4)_2(\text{H}_2\text{O}, \text{OH})_2
\]

**Locality**: Am Roten Berg, Schneeberg–Neustädtel, Saxony, Germany.

**Occurrence**: Found in the oxidation zone of the deposit associated with quartz on the type specimen. Associated minerals on other samples are: Co- and Ni-bearing mawbyite, cobaltlotharmeyerite, galena, arseniosiderite and plumbogummite.

**General appearance**: Rosette-like aggregates (up to 2 mm in diameter) composed of tabular crystals up to 0.3 mm.

**Physical, chemical and crystallographic properties**:
- **Luster**: adamantine.
- **Diaphaneity**: transparent.
- **Color**: brown to red-brown.
- **Streak**: light brown.
- **Luminescence**: nonfluorescent.
- **Hardness**: VHN25 500 kg/mm², Mohs 4½.
- **Tenacity**: brittle.
- **Cleavage**: {001} good.
- **Fracture**: conchoidal.
- **Density**: could not be measured, 5.31 g/cm³ (calc.).
- **Crystallography**: Monoclinic, \( C2/m \), \( a = 9.097 \), \( b = 6.313 \), \( c = 7.555 \ \text{Å} \), \( \beta = 115.08° \), \( V = 393.0 \ \text{Å}^3 \), \( Z = 2 \), \( a : b : c = 1.4410 : 1 : 1.1967 \). Morpology: \{201\} dominant, \{001\} and \{111\}. Twinning: none mentioned.
- **Optical data**: Biaxial (+), \( \alpha = 1.92 \) (calc.), \( \beta = 1.94, \gamma = 1.98, 2V(\text{meas.}) = 70° \), dispersion not determined; pleochroism strong, \( X \) light brown, \( Y \) red-brown, \( Z \) yellow; \( X \Lambda c = 15° \) in acute angle \( \beta \), \( Y = b, Z \Lambda a = 40° \) in the obtuse angle \( \beta \).
- **Chemical analytical data**: Mean of seven sets of electron-microprobe data: CaO <0.05, NiO 5.20, CoO 9.10, CuO <0.05, ZnO 0.52, PbO 34.23, Al₂O₃ 0.29, Fe₂O₃ 8.47, Bi₂O₃ <0.05, P₂O₅ 0.06, V₂O₅ <0.05, As₂O₅ 12.49, SO₃ 0.09, H₂O (4.65), Total (99.10) wt.%. Empirical formula: \( \text{Pb}_{0.97}(\text{Co}_{0.77}\text{Fe}^{3+}_{0.67}\text{Ni}_{0.44}\text{Zn}_{0.04}\text{Al}_{0.04})\Sigma_{1.96}[(\text{AsO}_4)_2(\text{SO}_4)_0.01(\text{PO}_4)_0.01]\Sigma_{2.04}[(\text{H}_2\text{O})_{1.41}(\text{OH})_{0.46}]_{21.87} \). **Relationship to other species**: It is a member of the tsumcorite group, specifically, the cobalt-dominant analogue of tsumcorite.

**Name**: Reflects the relationship to tsumcorite.

**Comments**: IMA No. 1999–029.

Cronusite

Ca$_{0.2}$(H$_2$O)$_2$CrS$_2$

**Locality:** Norton County meteorite (enstatite achondrite), which fell on February 18, 1948, in Nebraska, U.S.A.

**Occurrence:** Associated minerals are: enstatite, ferroan alabandite, troilite and daubréeelite. Cronusite is a product of the terrestrial weathering of caswellsilverite, NaCrS$_2$.

**General appearance:** Grains up to 1 mm.

**Physical, chemical and crystallographic properties:** *Luster:* submetallic. *Diaphaneity:* opaque. *Color:* coal black. *Streak:* black. *Hardness:* VHN$_{10}$ 98 kg/mm$^2$, Mohs 1½. *Tenacity:* sectile. *Cleavage:* {001} perfect. *Fracture:* uneven. *Density:* 2.51 g/cm$^3$ (meas.), 2.54 g/cm$^3$ (calc.). *Crystallography:* Trigonal, R$_3$m, R$\bar{3}$m or R32, a 3.326, c 33.29 Å, V 318.9 Å$^3$, Z = 3, c/a = 10.0090. *Morphology:* no forms were observed. *Twining:* none mentioned.


**Optical data:** In reflected light: gray, strong anisotropism, strong bireflectance, pleochroic in gray colors. R$_1$, R$_2$: (14.5, 15.8%) 460 nm, (15.7, 17.6%) 540 nm, (16.2, 18.2%) 580 nm, (16.6, 18.6%) 660 nm.

**Chemical analytical data:** Mean of six sets of electron-microprobe data: K 0.6, Ca 4.2, Cr 33.7, S 39.1, O 21, H (calc.) 2.65, Total 101.25 wt.%. Empirical formula (based on Cr + S = 3): Ca$_{0.17}$K$_{0.03}$(H$_2$O)$_{2.11}$Cr$_{1.04}$S$_{1.96}$. *Relationship to other species:* None apparent.

**Name:** After Cronos, one of the Titans in Greek mythology, the son of Uranus and Gaea, alluding to the mixed meteoritic-terrestrial origin of the mineral.

**Comments:** IMA No. 1999–018.

Britvin, S.N., Guo, Y.X., Kolomensky, V.D., Boldyreva, M.M., Kretser, Yu.L. & Yagovkina, M.A. (2001): Cronusite, Ca$_{0.2}$(H$_2$O)$_2$CrS$_2$, a new mineral from the Norton County enstatite achondrite. Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva 130(3) 29-36 (in Russ.).